# Biodegradation for Treatment of POL-Contaminated Soil - Introducing a New Guidance Document

**Environment, Energy & Sustainability Symposium**
Denver, CO
4-7 May 2009

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# Report Documentation Page

*Form Approved*
*OMB No. 0704-0188*



| 1. REPORT DATE | 2. REPORT TYPE | 3. DATES COVERED |
|---|---|---|
| **MAY 2009** | | **00-00-2009 to 00-00-2009** |

| 4. TITLE AND SUBTITLE | 5a. CONTRACT NUMBER |
|---|---|
| **Biodegradation for Treatment of POL-Contaminated Soil -Introducing a New Guidance Document** | 5b. GRANT NUMBER |
| | 5c. PROGRAM ELEMENT NUMBER |
| 6. AUTHOR(S) | 5d. PROJECT NUMBER |
| | 5e. TASK NUMBER |
| | 5f. WORK UNIT NUMBER |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>**U.S. Army Corps of Engineers,Construction Engineering Research Laboratory (CERL),Champaign,IL,61826** | 8. PERFORMING ORGANIZATION REPORT NUMBER |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | 10. SPONSOR/MONITOR'S ACRONYM(S) |
| | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) |

12. DISTRIBUTION/AVAILABILITY STATEMENT
**Approved for public release; distribution unlimited**

13. SUPPLEMENTARY NOTES
**Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 4-7 May 2009 in Denver, CO.**

14. ABSTRACT

15. SUBJECT TERMS

| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
|---|---|---|---|---|---|
| a. REPORT<br>**unclassified** | b. ABSTRACT<br>**unclassified** | c. THIS PAGE<br>**unclassified** | **Same as Report (SAR)** | **29** | |

# What Are PWTBs?

- Public Works Technical Bulletins
- Sponsored by USACE HQ
- Variety of Subjects
- Available through Whole Building Design Guide
- Accessible at:
- http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215
- May have to use Alternate Path – CCB, Army/COE, then PWTB

# PWTB Contents

- Biodegradation Technology Description
- Army Examples of Implementation
- Literature Review
- Regulatory Review
- Related Technologies
- References

# Bioremediation

- Use of Microorganisms to Remove Pollutants
- Applicable to Variety of Pollutants
- Remedial Technology Using Microorganisms to Help Reduce Concentration of Petroleum Hydrocarbons in Soil
- Capability to Transform Contaminated Soil into Useful, Recyclable Material at Relatively Low Cost
- Complex Process
  - Nature and Amount of Pollutant
  - Actual Surrounding Environmental Conditions
  - Composition of Native Microbial Community
- Installation Sources
- Regulatory Environment More Stringent
- Optimization
  - System Parameters
  - Bioaugmentation

# General

- Hydrocarbons – Wide Range of Physical and Chemical Characteristics
- Microbiology – Types of Microorganisms
- Dominant Organisms or Groups of Organisms
- Changing Environments – Changing Populations
- Adaptation Wins
- Capacity to Use Hydrocarbons as Primary Source of Carbon and Energy
- Metabolic Pathways – Aerobic or Anaerobic
- Indigenous Organisms Present in Most Subsurface Systems
- Bioremediation - Ex-situ or In-situ
  - Ex-situ - Advantage – Control
  - Disadvantage – Expense and Disruption

# Fort Hood Experience

- Demonstrated Bioremediation with and without Bioaugmentation
- POL-Contaminated Sludges and Soil
- Constructed Permanent Biosite
- Capacity to Treat 1,600 cu yards, Store 250 Cu yards
- Six- month Cycle
- Goal <1,500 ppm of TPH
- Use as Intermediate Cover at Sanitary Landfill
- Demonstrated Environmental Parameter Optimization  Adequate
- Use of Additives Unnecessary

# Bio-site

- Designed In-house
- 6-inch Reinforced Concrete Pad, Seams and Joints Sealed, Sand Base, 80-mil Impermeable Liner, Leach Field
- 8-foot Fence
- Separate Staging Area
- 0.5 Percent Grade to Drain
- Reclaimed Water Available for Sprinkling
- Grit Collection Chamber for Suction Truck Slurry
- Operating Equipment
- Operations Building

# General Operating Procedures

- Incoming Soil to Staging Area
- Initial Samples for Testing
- Transfer to Treatment Pad
  - Spread and Layered
  - Nutrients Added and Tilled
  - Watering and Tilling as Needed
- Sampling Schedule
  - Constituents
  - Frequency
- Soil Disposition
- Documentation
- Windrows Also Demonstrated

# Fort Riley

- Similar Site to Fort Hood's
- Meet State-required Cleanup Levels
- Used as Fill for Construction Projects or Mixed with Compost
- Kansas Uses "Risk based" Action Levels
  - Different Categories of Risk


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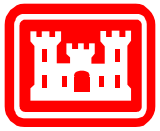
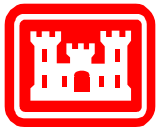
# State Regulations

- States Vary Widely
  - Responsible Agencies Vary
- Often BTEX, TPH, PAHs
- Usually Regulate Via Action Limits, Allowable Uses and Varying Concentrations
- Vary by Environmental Medium
- "Risk-based" Soil Cleanup Difficult - Many Factors Taken Into Account
  - Contaminant, Exposure Pathways, Material End-Use
- Several States Discussed in PWTB



# Texas Example

- TCEQ
- Risk-Based
- Tier 1 Default Cleanup Standards
- Tier 2 Site-Specific Calculation
- Contaminant of Concern, Different PCLs
- Protective Concentration Limit (mg/kg)
  - Tier 1 Industrial Soil
  - Benzene 110
  - Toluene 33,000
  - Ethyl benzene 10,000
  - Xylene 1,100



# Environmental Modification for Bioremediation

- Environmental Limitations Include Excessively High Waste Concentrations, Lack of Oxygen, Unfavorable pH, Lack of Mineral Nutrients, Lack of Moisture and Unfavorable Temperature
- Bioaugmentation
  - Seeding with Pollutant-degrading Bacteria
  - Rationale – Xenobiotics
- Great Majority of Cases - Inoculations Neither Necessary Nor Useful;
  - Exceptions - Biodegrading Microorganisms are Poor Competitors
  - Or When Co-metabolizing Takes Place
- Massive Accidental Spill of Toxic Chemical in Previously Unexposed Environment
- Always Provide Reasonable Growth Conditions, May Need Substrate in Some Cases

# Biopiles

- Similar Full-scale Technology –
- Excavated Soils are Mixed with Soil Amendments, Place on a Treatment Area and Bioremediated Using Forced Aeration or Turning Windrows
- Treatment Bed, Aeration System, Irrigation/Nutrient System, Leachate Collection System
- Control Moisture, Heat, Nutrients, Oxygen and pH
- Sometimes Plastic Covered
- Treat TPH Less Than 50,000 mg/kg

# Questions?

Contact information or for additional information or resources

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